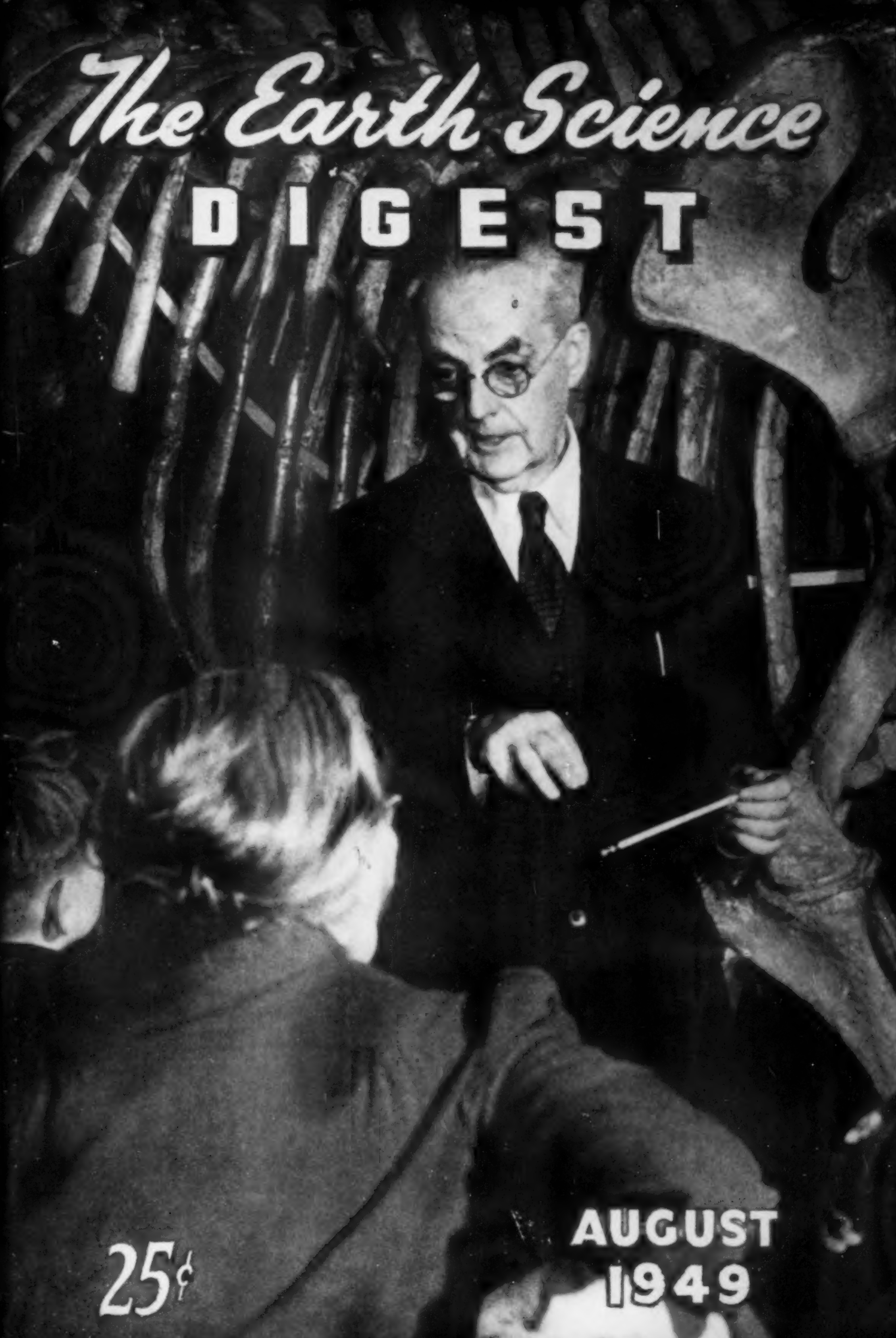
The Earth Science DIGEST



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AUGUST 1949

THE EARTH SCIENCE INSTITUTE

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S. Albert Eisenberg, Publisher

Gertrude Roberts, Business Manager

CONTENTS

PLANS BEING MADE FOR A GERMAN EDITION OF THE EARTH SCIENCE DIGEST

Arrangements are now being made for the publication of a German edition of *The Earth Science Digest*, "ERDWISSENSCHAFTEN, Zeitschrift fur die Friende der gesamten Mineralogie und Geologie". It will be published in cooperation with the Deutsche Gesellschaft der Freunde der Mineralogie, an organizational member of The Earth Science Institute. Godehard Lenzen will be in charge of the German edition, and will head the German editorial board. Mr. Lenzen is Editor of *Achat*, a German mineralogical and gemological magazine, and is on the Editorial Board of *The Earth Science Digest*. *Erdwissenschaften* will make its first appearance in January 1950. For further information write to Godehard Lenzen, Schliessfach 1125, Hamburg 1, Germany.

Underground Gasification of Coal Under Trial In North Africa

LAKE SUCCESS, N. Y., Aug. 6 (Science Service) — French experimental work in converting coal to gas, without its removal from the underground seams is to be reviewed here at the meeting this month of the United Nations Scientific Conference on the Conservation and Utilization of Resources by Prof. Doumenc of the St. Etienne, France, School of Mining.

The gasification of underground coal has been undertaken in past years in several parts of the world, notably in Russia and the United States. Satisfactory and economical commercial processes have not yet been developed although experimental work gives every promise for the early future.

The French work is being carried out in the Djerada anthracite field in Morocco. This anthracite contains only 5% of volatile matter and the problem is largely to convert the coal into carbon monoxide. Exceptionally favorable conditions exist for the experiment in the site selected because of the outcropping panel, the almost vertical dip of the seam, and the absence of flooding. On the other hand the composition of the coal and the thinness of the seams mean that the scheme will have to be planned with great care.

At the same meeting an American experiment in gasifying coal in place under ground will be discussed by M. H. Fies, of the Alabama Power Co., and James L. Elder of the U. S. Bureau of Mines. The undertaking is a joint project, near Gorgas, Ala., of these two organizations and is now in its second year.

The first year's work was successful. A better quality gas is expected this year from the experience gained. Other objectives of the second experiment are to determine the quantity of coal that can be gasified from a given initial combustion zone and the shape and the extent of the burned-out areas formed during the gasification. Also it is designed to test various types of installations and to determine their operational characteristics under variations of conditions.

Meetings and Conventions

Meteoritical Society, 12th Annual Meeting, September 6-7, 1949. University of Southern California, Los Angeles, Calif.

National Petroleum Association, Annual Meeting. Sept. 14-16, 1949. Hotel Traymore, Atlantic City, N. J.

Earth Science Institute, First General Meeting. Sept. 30, 1949. Boston University, Boston, Mass.

New England Intercollegiate Geological Excursion. Oct. 14-16, 1949. Tufts College, Medford, Mass. Oct. 14; Squantum field trip (Squantum tillite), Prof. Robert Shrock, M.I.T., Leader. Oct. 15; Chelmsford field trip (Chelmsford granites and geology of the adjacent areas), Dr. L. W. Currier, U.S.G.S., Leader. North Shore field trip (shore line geomorphology, glacial geology, bedrock geology), Profs. Robert L. Nichols & Charles E. Stearns, Tufts College, Leaders. Oct. 16: Hingham field trip (bedrock geology), Prof. Marland P. Billings, Harvard University, Leader; Field trip to classic areas for shoreline and glacial geomorphology, Prof. Robert L. Nichols, Leader.

Geological Society of America, 62nd Annual Meeting; Paleontological Society, 41st Annual Meeting; Mineralogical Society of America, 30th Annual Meeting; Society of Vertebrate Paleontology, 9th Annual Meeting. Nov. 10-12, 1949, Cortez Hotel, El Paso, Texas.

SOIL EROSION IN SOUTHERN RUSSIA

WILHELM F. SCHMIDT

Mineralogischen-Geologischen Institut der Technischen Hochschule
Braunschweig, Germany

Gullied slopes near a village on the Oskol River, Eastern Ukraine. The wild river bed is shown by this air photo. The borders of the gullies differ in sharpness, according to the different character of the soils and rocks. The gullies are growing back into the undestroyed backland.

Vast areas of the steppes in Southern Russia are being destroyed by soil erosion. Steep slopes are cut by deep and long gullies. All the gullies begin at these slopes and grow deep into the higher situated backland of the steppes. Some regions suffered especially under the formation of these gullies and it is almost impossible to cultivate the soil. The formation of the gullies causes a steady sinking of the groundwater level. These deep gullies make it impossible for the peasants to get to their fields on a direct road. The food-growing population concentrates on certain parts of the Ukraine while other parts are deserted because of the disadvantages of soil erosion. What other way out is there than by emigration? These emigrants usu-

A loess-gully near Lubny on the Sula River, Ukraine.

ally seek the steppes of Southern Siberia where virgin soil is waiting for newcomers to start agriculture — and perhaps in consequence new soil erosion.

How familiar the Russian people are with this problem is proven by some of their terms. They call the fresh deep gully of erosion an *ovrag* and the long stretched older one a *balka*.

Not all of the gullies of the steppes were induced by man. Certain gullies seem to be rather old. Studies of special geological profiles within longer ravines and gullies show that there were periods with frequent fully erosion. During other periods in which plain-building occurred these gullies were filled up with loess and alluvials (periglacial conditions). The grotesque shapes worked into soft materials such as loess, shales, and marls, can only develop under the influence of extreme climatic conditions.

During the summer in Southern Russia there is no rain for four months, except for occasional torrential rains. The surface of the soil becomes dry and a crust is formed so that all the morphological features appear very distinct. In these months the wind blows the pulverized materials out of the gullies. It begins to rain by the end of autumn and the soil becomes muddy. The walls within

Deep ravines cutting the slopes of the high western side of the Don Valley, 45 miles west of Stalingrad. Resulting from erosion, these ravines reach a depth of 150 feet. The rocks are limestone, chalk, glauconitic sandstones, shales, sands, loess, and others (Upper Cretaceous, Tertiary, and Quaternary).

the gullies begin to slip and break down, and as a consequence of the heavy rains the gully changes into a torrent.

The winter begins; a Russian winter with strong frost. The cover of vegetation is very thin and there is none at all on the bare walls of the *ovrags*. The frost can act to a depth of as much as six feet. There are temperatures of minus 40° to 50° C. in Southern Russia and the deep frozen soil does not thaw before the end of April. Snowfalls take place towards the end of the winter. When the snow melts during a very short period water must run off on the surface, because in the beginning only the upper part of the soil becomes soft. Melting water can

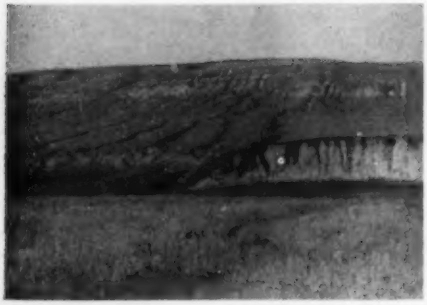
Gullies of erosion along the western steep riverside of the Donez River. They grow from the slope into the cultivated backland. This airplane photo shows the roads which try to avoid the ends of gullies. Alluvions are seen in frrnt of the gully exits.

easily erode the soil above a still frozen deeper soil. New rills of erosion develop and the existing gullies grow.

Most of the gullies are found along the steep western slopes of the Southern Russian stream and river valleys: Dnepr, Sula, Oskol, Donez, Don, etc. Some relatively high regions are gullied in the same way. These areas usually show signs of young rising. If the underground consists of thick loess, the *ovrags* have especially steep walls. But there are also similar types of gullies all over the country where morphologic, climatic, and vegetative conditions are offered in favor of that process. The net of gullies covers the land without being influenced by the peculiarities of soil and formation. Only hard rocks such as granite resist gully erosion.

More than one hundred years ago travellers reported the deep gullies in the steppes of Southern Russia. The natives were afraid of them because cattle plunged into them and men were in constant danger while using paths and roads. Special caution was necessary in winter, when the *ovrags* were filled up with snow.

Since the middle of the nineteenth century *ovrags* have become more numerous. The growing population and the changing of



Erosion rills at a steep slope east of Raspopinskaja on the Don River. These are Upper Cretaceous and Tertiary rocks covered by sands and loess of Quaternary age.

vast steppe areas into agricultural districts drew serious consequences as to soil erosion. Trees and woods, essential for the building up of civilization even on a modest scale, disappeared more and more, beginning with the steep slopes. This meant the beginning of man-induced erosion. Unregulated river beds and stream valleys gave room to the enormous amount of material moved by soil erosion. Coarse-grained material washed out of the gullies built up large sandbanks and forced the rivers into new beds while the finer materials of the eroded soil were carried away, causing the dark color of the muddy waters. Vast lands lost their value and became unfit for agriculture. *Ovrags* were stopped by primitive methods at first, but later on various systems were employed, some resembling in part those used in the United States. Organizations set up for this purpose are called "Stations for Ovrag Fighting Research Work."

The accompanying photos taken from the air show all the details about the gullies and gully formation with great distinction. Valuable land suffers under the strokes of the everlasting attacks of the most powerful enemy of agriculture: soil erosion.

Recommended Reading

Earth science articles appearing in current periodicals which we believe would be of interest to our readers are listed below.

BULLETIN OF THE GEOLOGICAL SOCIETY OF AMERICA, Vol. 60, No. 7, July '49.

"Geologic Mapping in the United States", by Leona Boardman. 1125-32.

ROCKS AND MINERALS, Vol. 24, Nos. 7-8, July-August, 1949.

"Columbian Emerald Sources", by Ronald L. Ives. 339-345.

"The Fitchburg Rollstone", by Charles Palache. 347-349.

SCIENCE AND MECHANICS, Vol. 20, No. 4, August, 1949.

"Plenty of Oil for the Making". 67-71.

SCIENTIFIC AMERICAN, Vol. 180, No. 6, June, 1949.

"The Blister Hypothesis", by C. W. Wolfe. 16-21.

THE MINERALOGIST, Vol. 17, No. 7-8, July-August, 1949.

"Improvements Needed in Geiger Field Counters", by Jack DeMent. 339-342.

"More About Loess", by F. L. Fleener and Ben Hur Wilson. 348-350.

"Opal—Color Composite of all Gems." 352-360.

THE SCIENTIFC MONTHLY, Vol. 49, No. 1, July, 1949,.

'Origins of Geologic Terms", by Frederick A. Burt. 20-21.

"One Hundred Years of California Placer Mining", by H. A. Sawin. 56-62.

COVER PHOTO

Dr. William King Gregory, renowned paleontologist and morphologist, at the final meeting of his last class in vertebrate evolution at the American Museum of Natural History. Now emeritus, Dr. Gregory continues to fill his days with the work he loves — research and writing in the field in which he still ranks paramount.

American Museum of Natural History photo.

THE SEARCH FOR URANIUM

W. S. SAVAGE
Ontario Department of Mines

*Part Three of a Three-part Article**

Methods of Analysis and Interpretation of Assays

The chemical analysis of radioactive ores is a lengthy and involved process, and as a result it is seldom done until the merit of a deposit has been established. Physical analysis, made by comparing the radioactivity of submitted specimens with that of known standards, is the general method of assaying used in the Canadian Government laboratories at both Ottawa and Toronto. For this purpose, a large, very sensitive type of Geiger counter is employed. This instrument has one important disadvantage in that it does not distinguish between radioactivity caused by thorium and radioactivity due to uranium. This distinction can only be made by identifying the mineral that causes the radioactivity by chemical analysis, or by determining spectrographically the elements responsible.

The results of physical analysis obtained by use of the laboratory-type Geiger counter are expressed in terms of radioactivity *equivalent* to a certain percentage of uranium oxide. In using and interpreting these results it should be clearly understood that for any given specimen the uranium oxide equivalent does not necessarily mean that the specimen contains the stated percentage of uranium oxide. The radioactivity may be due in part or in total to thorium. Even the uraninte present in the Wilberforce area, while theoretically an oxide of uranium, carries as much as 15 per cent of thorium oxide.

Considerations in Prospecting in Canada

The first step in planning to prospect for radioactive minerals is to become familiar with the regulations affecting new discoveries and marketing.** These regulations are set down in a series of leaflets issued from time to time and published in the press. Copies of these leaflets can be obtained by writing to the Chief of the Geological Survey of Canada, Department of Mines and Resources, Ottawa.

Prospecting and disclosure of information has been cleared of restrictions, with the exception that all new discoveries must be reported to Ottawa. Permits must be obtained from the Atomic Energy Control Board before proceeding with any development work other than that required for making a discovery. It is now possible to develop a radioactive deposit to the production stage as a private enterprise, but the concentrates must be sold to the Canadian Government Purchasing Agency.

On March 16, 1948, the Canadian Government guaranteed for a period of five years to purchase acceptable uranium-bearing ores or concentrates at a minimum rate of $2.75 per pound of contained

*Publisher by permission of the Deputy Minister, Ontario Department of Mines.

**For information on the U. S. Atomic Energy Commission regulations see page 11.

uranium oxide, f.o.b. rail. The ores or concentrates must normally contain a minimum of 10 per cent weight of uranium oxide, but under special circumstances consideration may be given to payment of a higher price or to acceptance of concentrates of lower grade.

A prospector should realize that many of the common radioactive minerals do not carry 10 per cent uranium oxide even in the pure form, and it is therefore not possible to produce a 10 per cent concentrate. It is also important to bear in mind that the concentrate must be acceptable to the Government, and it is highly improbable that they would accept a complex ore made up of several minerals, which could not be treated by existing methods. Today, however, many of our large gold mines are operating on ore bodies that formerly were not of commercial grade and it is safe to predict that methods will be developed to mine uranium deposits that are not now regarded as ore.

In prospecting for radioactive minerals, it is necessary to consider future possibilities as well as present conditions. With further advances in the commercial use of atomic power, certain minerals now considered undesirable might become valuable, and the over-all demand might result in an increased price for concentrates. On the other hand, intensive prospecting for radioactive minerals with the aid of the Geiger counter is in its infancy. It is possible that major discoveries of pitchblende will be made, which could result eventually in lower rather than higher prices for concentrates.

No provision is made at present for purchasing concentrates of thorium-bearing minerals. To date it is not possible to release nuclear energy from thorium, and thorium can be obtained at a relatively low price for other purposes from the extensive monazite beach deposits of India, Brazil, and Australia. The policy of the Government with regard to thorium is stated in a leaflet released on November 2, 1948.

Areas For Prospecting in Canada

While it is possible to offer some advice in directing the search for radioactive minerals, it would be unwise to eliminate any areas on the basis of present knowledge. The intensive search for radioactive deposits now being carried out with the assistance of the Geiger counter has already produced results under a wide variety of geological conditions.

Experience to date suggests that uranium deposits are genetically associated with acid igneous rocks. A large variety of radioactive minerals has been found in pegmatite dikes, but they generally occur as disseminated crystals.

A. H. Lang points out that the Canadian shield contains the most important uranium deposits so far discovered in Canada and, consequently, appears to offer the most favorable areas for prospecting. The distribution of the known occurrences in the shield is interesting, for practically all of them are near its western and southern margins.

Reference to the geological map of Canada (820A) of the Geological Survey of Canada will show that the uranium deposits at Great Bear Lake, the occurrences in the giant quartz vein belt between that lake and Great Slave Lake, and the discoveries at Lake Athabaska and Lac la Ronge are all in the western edge of the shield. Farther east, the pegmatite area of southeastern Manitoba, the Lake Superior region, including the recent pitchblende discovery at Theano point, and the pegmatite belt extending from Georgian bay to the Saguenay region, are all in the southern margin of the shield. Two explanations can be suggested for these geographical relationships, both of which may be valid to some extent. The first explanation is related to accessibility, for there can be little doubt that the proximity of these discoveries to large bodies of water or other aids to transportation has influenced their discovery; consequently when the entire shield has been well prospected the pattern of uranium discoveries may be greatly different. On the other hand, it has been fairly clearly established that different metals tend to occur in different parts of the shield, sometimes referred to as metallogenic provinces. Many of the pitchblende deposits occur in late Precambrian rocks that have been folded, and these deposits may be considerably younger than many of the gold and base-metal deposits occurring in the shield. The fact that most of the known belts of folded late Precambrian rocks are near the edges of the shield may, therefore, be partly responsible for the distribution of pitchblende deposits.

At Eldorado (Great Bear Lake), the pitchblende occurs in sheared zones cutting metamorphosed sediments and diabase in the vicinity of a large body of granite. The sheared zones strike northeastward and dip north. The principal gangue minerals are quartz, calcite, and hematite. Pitchblende occurs most commonly as persistent, lenticular veins a few inches wide or as a lacing network of stringers with some coarse dissemination. In some cases the pitchblende was later broken up and brecciated and the fragments recemented by quartz. These ore bodies, as far as tonnage is concerned, are generally believed to be the richest pitchblende deposits known.

The so-called "giant quartz veins", which are a conspicuous feature of the northwestern part of the Canadian shield, are large quartz stockworks consisting of a network of quartz stringers with the intervening rock commonly replaced by silica. In places, these bodies have been reopened by fracturing and mineralized by later quartz, hematite, and pitchblende. In some of these deposits the pitchblende is too sparse or too scattered to be of interest, but others in the area north of Great Slave Lake are being developed in the hope that minable ore bodies may be outlined. If these efforts are successful, numerous other "giant quartz veins" that may be prospected will be found indicated on geological maps.

One of the uranium deposits in the Northwest Territories consists of beds of dolomite containing considerable amounts of hematite and some uranium and thorium. Work is being done to test the size and grade of the deposit and the nature of the radioactive minerals and to decide whether these minerals are original constituents of the sedimentary rock or whether they were introduced after the formation of the rock. Until these questions are settled, prospecting for other deposits of this kind cannot be specifically recommended.

The uranium deposits near Wilberforce, Ontario, occur in a band of sedimentary gneiss much invaded by pegmatite dikes. The uraninite occurs as well-formed crystals and as nodular lumps of pitchblende, often coated with a various alteration products, including gummite, autunite, and torbernite.

The Cordilleran region in the West ranks next to the Canadian shield in the occurrence of metalliferous deposits in general and of uranium-bearing deposits, but none of the latter has yet been developed to the producing stage. Uranium has been found at several widely scattered localities in British Columbia, the most important discoveries to date being in deposits that had been developed previously because of the occurrence of other metals. The discovery that has attracted greatest attention is at the Gem property in the Bridge River district. The uranium at this property is asociated with lenses of an iron-cobalt sulpharsenide mineral in altered granodiorite.

It is unlikely that any commercial deposit of secondary uranium minerals will be found in the Canadian shield. The glaciation that scoured most of the country during the last Ice Age removed any accumulations that might have existed prior to that date, and there has not been sufficient time since the Ice Age for any sizable bodies to accumulate.

The conditions under which the extensive carnotite deposits in Colorado and Utah have already been described.

The rich uranium ore in the Belgian Congo is pitchblende accompanied by chalcolite (torbernite), curite, and kasolite. The last two are more or less peculiar to the district. The pitchblende occurs in veins with the torbernite and associated minerals adjacent to the walls. The veins are narrow, branching, and very irregular in strike, dip, and thickness. The country rocks are sedimentaries, which have been highly metamorphosed.

In South Africa, pitchblende has been found to occur in the "banket" or gold-bearing conglomerates of the Rand, and it is reported to be associated with graphitic material in the ore.

Uranium is recovered in Sweden from oil shales that carry radioactive minerals in thin beds consisting of coal-like nodules called "kolm." The uranium oxide content is low, but when the "kolm" is burnt, the uranium cotent is considerably higher in the ash.

These few examples, chosen from numerous others throughout the world, serve to demonstrate the varied mode of occurrence of radioactive minerals and show the wide field of possibilities that exists in the search for urainum ores.

REFERENCES:

NELSON HOGG, "Prospecting for Radioactive Minerals," Ont. Dept. Mines, unpublished manuscript.

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"Prospectors' Guide for Uranium and Thorium Minerals in Canada," Bur. Mines, Dept. Mines and Resources, Ottawa.

H. V. ELLSWORTH, "Rare - Element Minerals of Canada, Geol. Surv. Can., Econ. Geol. Series No. 11.

H. V. ELLSWORTH, "Radioactivity," in "Prospecting in Canada," Geol. Surv. Can., Econ. Geol. Series No. 7 pp. 211-221.

J. DeMENT and H. C. DAKE, "Handbook of Uranium Minerals," Mineralogist Publishing Co., Portland, Oregon.

A. H. LANG, "Prospecting for Uranium in Canada," Geol. Surv. Can., Paper 49-4.

WORLD URANIUM OCCURRENCES

From **HANDBOOK of URANIUM MINERALS.**

U. S. ATOMIC ENERGY COMMISSION DOMESTIC URANIUM PROGRAM*

The United States Atomic Energy Commission has announced a three-point program to stimulate the discovery and production of domestic uranium by private competitive enterprise.

The major elements of the program are:

1. Government guaranteed ten-year minimum prices for domestic refined uranium, high-grade uranium and mechanical concentrates.
2. A bonus of $10,000 for the discovery and production of high-grade uranium ores from new domestic deposits.
3. Government guaranteed 3-year minimum prices for the low-grade carnotite- and roscoelite-type uranium-vanadium ores of the Colorado plateau area and Government operation of two vanadium-uranium plants in that area.

Uranium in deposits on the public lands, and other lands owned by the United States, is now reserved to the United States, subject to mineral rights established on or before August 1, 1946 (the date of the Atomic Energy Act). However, the Commission's guaranteed minimum prices have been made applicable to deliveries to it of ores containing such reserved uranium in consonance with the Commission's authority to pay fair and reasonable sums, including profits, for discovery, delivery, and other services performed with respect to such ores. The Commission wishes to encourage prospecting for new deposits of uranium ores on the public domain and has been advised by the Department of the Interior, which administers the disposition of the public lands, that valid locations may be staked on such deposits if the uranium occurs in a deposit which is valuable because of other minerals. In the unlikely event of the discovery of a deposit of uranium-bearing ore which does not contain some other valuable mineral, the Commission, upon notice, will take steps to protect the prospector's equity.

*Excerpts from the United States Atomic Energy Commission Press Release No. 96.

The price and bonus program, which is detailed in circulars available from the Commission, is essentially as follows:

Domestic refined uranium, high-grade uranium-bearing ores and mechanical concentrates

The AEC guarantees minimum prices for delivery to it of domestic refined uranium, high-grade uranium-bearing ores and mechanical concentrates in accordance with the terms of its circular for 10 calendar years. The guaranteed minimum prices are:

Uranium-bearing Ores and Concentrates. $3.50 per pound of recoverable uranium oxide, less the cost per pound to refine to necessary purity as determined by the AEC after assay of a representative sample.

Refined Uranium Products. $3.50 per pound of uranium oxide.

The prices established are minimum prices for small lots. Higher prices may be established by negotiation with the seller for larger quantities, taking into consideration such factors as refining

AMERICAN *CARNOTITE* LOCALITIES

From **HANDBOOK of URANIUM MINERALS.**

and milling costs, transportation costs and other applicable items. The Commission also will give consideration to the presence of recoverable gold, silver, radium, thorium and other valuable constituents of the ores, depending upon the cost of recovery.

Bonus for discovery and production of domestic uranium ores

As a special incentive to stimulate prospecting for new high-grade domestic uranium deposits, other than deposits of so-called carnotite or roscoelite ores, the AEC will pay in addition to the prices established under the purchase schedule a bonus of $10,000 for the production, upon delivery to the Commission, of the first 20 short tons of uranium ore or mechanically produced concentrates assaying 20 percent or more uranium oxide from any single lode or placer mining location on the public domain which has not previously been worked for uranium, or from a comparable area on private property. The discovery bonus will be paid only once for the production of ore from any single lode or placer location but the same person may receive a bonus for the production from each new location. Although this offer does not apply to production of carnotite or roscoelite ores, a special development allowance in addition to the base price has been provided to encourage discoveries of such ores.

Uranium-Bearing Carnotite- or Roscoelite-type ores of the Colorado plateau area

The AEC guarantees a minimum price schedule for delivery to it of carnotite- or roscoelite-type ores at Monticello, Utah, or Durango, Colorado. The minimum prices, effective for three calendar years, are the highest per ton of average ore ever paid in the Colorado plateau area. Independent producers are currently receiving $13.80 per ton from private industry for ore containing 2 percent vanadium oxide and 0.2 percent uranium oxide. Under the Atomic Energy Commission schedule the producers will receive $20.40 per ton for this grade ore.

The Commission has concluded that the increase in prevailing prices is necessary to stimulate exploration and increased production.

The schedule provides for payment of $1.50 per pound of uranium oxide for the delivery of ores assaying 0.20 percent, plus a development allowance of 50 cents per pound. Premiums will be paid for delivery of certain higher grade ores and a lower price will be paid for delivery of ores containing less than 0.20 percent uranium oxide with no payment for ores containing less than 0.10 percent. Payment also will be made based on the vanadium oxide content of the ore at 31 cents per pound for an amount not exceeding ten pounds for each pound of uranium oxide. No payment will be made for vanadium oxide in excess of this amount.

Circulars describing the ore-buying program are available from the Commission's Washington, D. C. headquarters, from the AEC office in Grand Junction, Colorado, and from the office of the AEC at 70 Columbus Avenue, New York.

HEAT TREATMENT GIVES LONG LIFE TO QUARTZ CRYSTALS

FORT MONMOUTH, N. J. July 15 (Science Service) — Quartz crystals, essential in radio and television, will have practically unlimited frequency-control life without deteriorating as a result of a heat-treatment process revealed here at the laboratories of the U. S. Army Signal Corps where it was discovered.

The process involves superheating the crystal to approximately 900 degrees Fahrenheit, followed by slow cooling. Finished blank crystals are placed on a conveyor belt and passed through an electrically heated oven for a period of from two to three hours, then subjected to cooling through a 24-hour period.

The job of the quartz crystal in all types of radio transmission, and in other electronics, is to keep the emitted signals on their assigned radio-wave frequency. But these crystals age in use, permitting the signal to slide or "drift" away from the desired frequency. They must then be replaced. A crystal which has been subjected to the new Signal Corps process, however, will hold to the desired channel indefinitely, and probably will never have to be replaced.

The discovery, made by Arthur C. Prichard, Maurice A. A. Druesne and Dr. David G. McCaa of the Signal Corps laboratories, is of vast importance not only to the armed forces but to civilian radio, television and communications, in all of which great quantities of quartz crystals are now used. They are imported products, because few satisfactory crystals have ever been found in the United States. Had this new method been available during the recent war, many millions of dollars spent for replacements would have been saved.

New Books

All books listed here are deposited in the Library of The Earth Science Institute and may be borrowed by the members. Books marked with an asterisk may be purchased through The Earth Science Publishing Co., Revere, Mass.

*PRINCIPLES OF STRUCTURAL GEOLOGY,

by Charles M. Nevin. 4th Edition. 1949. 410 pp., 7 pls., 250 figs.; $6.00. (John Wiley & Sons, Inc., New York). The text has been expanded and thoroughly revised. It deals with the deformations of the earth, emphasizing the understanding and interpretation of structures. In this new edition, the specific citations to the literature usually scattered throughout the text are omitted, and in their place "selected references" are given at the end of each chapter. A new section, "Laboratory Exercises", has been added, emphasizing graphic solutions, by which use "the student is encouraged to think in three dimensions."

PROSPECTING FOR URANIUM,

prepared by the U. S. Atomic Energy Commission and the U. S. Geological Survey. 1949. 123 pp., illus.; $0.30. (Superintendent of Documents, Govt. Printing Office, Washington 25, D. C.) This pocket-sized book discusses the occurrence, identification, and sale of uranium ores; geiger counters; etc.

*DIE LEBENSWEISE DER DINOSAURIER,

by Martin Wilfarth. 1949. 96 pp., 3 pls., 68 figs.; DM 12. — (about $3.60). A comprehensive study of the life and living habits of the dinosaurs. (E. Schweizerbart'sche Verlagsbuchhandlung, Stuttgart, Germany).

*LANDSCAPE AS DEVELOPED BY THE PROCESSES OF NORMAL EROSION,

by C. A. Cotton. 2nd Edition 1948. 509 pp., 1 pl., 375 figs.; $10.00. (John Wiley & Sons, Inc., New York. Printed in New Zealand). This considerably enlarged edition of Dr. Cotton's work features many new photographic illustrations and has been rewritten in part. The book deals with landforms in moist climates, and among some of the things thoroughly discussed are the erosion cycle, river piracy, homoclinal features, river terraces, peneplains, fault scarps, and limestone caverns.

*AMERICAN PERMIAN NAUTILOIDS,

by A. K. Miller and Walter Youngquist. 1949. 218 pp., 59 pls., 39 figs.; $3.50. (Memoir 41, The Geological Society of America, New York). About 100 species of nautiloids have been found in the Permian of the Americas, being especially widely distributed in the marine Permian of the Western United States. Southwestern Canada, northeastern Mexico, and northern Columbia account for a few specimens. They have been grouped into nine families. The systematic paleontology of these fossils comprises the main part of this work.

REPORT OF THE COMMITTEE ON THE MEASUREMENT OF GEOLOGIC TIME, 1947-1948, INCLUSIVE;

John Putnam Marble, Chairman. 1949. 77 pp., $1.00 (Division of Geology and Geography, National Research Council, Washington 25, D. C.) This report features an Annotated Bibliography of Articles Relating to the Measurement of Geologic Time, compiled by Dr. Marble. (Checks, money orders, etc., should be drawn in favor of the National Academy of Sciences).

MANGANESE DEPOSITS OF THE SERRA DO NAVIO DISTRICT, TERRITORY OF AMAPA, BRAZIL,

by J. Van N. Dorr II, C. F. Park, Jr., and Glycon de Paiva. 1949. 55 pp., 4 pls., 1 fig.; $0.45. (Bulletin 964-A, U. S. Geological Survey, Washington, D. C.) These impressive deposits of manganese oxide, discovered in 1941, may contain as much as 4,000,000 tons of ore, 585,000 tons of which are visible. Other deposits probably remain undiscovered.

*BIBLIOGRAPHY OF FOSSIL VERTEBRATES, 1939-1943,

by C. L. Camp, S. P. Welles, and Morton Green. 1949. 371 pp.; $4.50. (Memoir 37, The Geological Society of America, New York). This book is the third in a series covering world literature on vertebrate paleontology. It includes an author catalogue, subject index, systematic index, and a synopsis of classification.

*SEDIMENTARY FACIES IN GEOLOGIC HISTORY,

Chester R. Longwell, Chairman. 1949. 171 pp., 5 pls., 61 figs.; $1.75. (Memoir 39, The Geological Society of America, New York). This collection of papers was presented as a conference at the G. S. A. meeting in New York, November 11, 1948. The principal addresses are: Meaning of Facies, by Raymond C. Moore; Facies Changes in the Colorado Plateau, by Edwin D. McKee; Sedimentary Facies and Geologic Structures in the Basin and Range Province, by Siemon Wm. Muller; Sedimentary Facies and Associated Diastrophism in the Upper Cretaceous of Central and Eastern Utah, by Edmund M. Spieker; Oligocene Faunas, Facies, and Formations, by Horace Elmer Wood, 2nd; Integrated Facies Analysis, by L. L. Sloss, W. C. Krumbein, and E. C. Dapples.

*COPPER IN CALIFORNIA,

prepared under the direction of Olaf P. Jenkins. 1948. 429 pp., 61 pls. (52 maps), 22 figs.; $6.00 (Bulletin 144, California State Division of Mines, San Francisco, Calif.) This study includes detailed reports on the Foothill copper belt, the economics and treatment of ores, and a tabulation of copper properties.

INSECTS IN BALTIC AMBER HELD OLDER THAN FIRST THOUGHT

WASHINGTON, July 21 (Science Service) — Ants and other insects embalmed in Baltic-region amber may have their ages revised upward quite radically. Hitherto they have been considered to be of Lower Oligocene date, some 8,000,000 or 9,000,000 years old.

Now, however, at least two outstanding scientists hold them to belong to the much earlier Lower Eocene, near the beginning of the Age of Mammals, and a good 55,000,000 or 60,000,000 years old. This new dating is agreed on by Dr. Frank M. Carpenter, Harvard University entomologist, and Dr. J. P. Marble, geologist of the U. S. National Museum.

BRAZILIAN COAL RESERVES ARE ENOUGH FOR TWO CENTURIES

Coal reserves in the producing areas of Brazil are estimated at 380,000,000 to 650,000,000 tons — enough to last more than two centuries at the present rate of production — the U. S. Bureau of Mines reveal. Although the State of Santa Catarina is the largest coal producer, additional quantities are mined in the States of Rio Grande do Sul, Parana, and Sao Paolo.

New Developments Permits Drilling Deep Wells For Oil

NEW YORK, Aug. 6 (Science Service) — New developments in drilling 20,000-foot wells in the search for oil are to be discussed at the Lake Success, N. Y., meeting of the United Nations Scientific Conference on the Conservation and Utilization of Resources, to be held this month, by I. S. Salnikov of the Standard Oil Company.

A 1,500-foot well was regarded as deep a half century or so ago, and drilling to that depth was a relatively easy job. America's first oil well, bored at Titusville, Pa., soon after the discovery of oil in 1859, was 695 feet in depth. Only 20 years ago, a 9,000-foot well was considered an epic achievement. The first 15,000-foot well was drilled in 1938. Since World War II, four wells in succession have set new records below that depth, and a well in Wyoming, not yet completed, is now below the 20,000-foot mark.

The first oil-well-drilling equipment was the cable tool rig which, in one form or another, has been used to punch holes in the ground since the beginning of recorded history. The standard cable tool method was used in the United States almost exclusively until 1900. A year later the rotary drilling method came into general use in this country. But although steady improvements were made, pre-war equipment is not satisfactory to obtain the great depths of these post-war deep wells.

The most important developments in rotary drilling are in the unitization and portability of drilling rigs and equipment; better quality steel for drilling equipment; improved designs; improvement in drilling muds; better understandng of hydraulics in mud systems; and proper application of weight on the bit and rotating speeds. Unitization and portability have made drilling more economical but have not added much to the depth problem.

Backward-Flowing River Forms Delta at Wrong End

KENT, Ohio, July 17 (Science Service) — The fabulous horse with its head where its tail ought to be has a counterpart in a short river in the State of Maine, which has a delta at its head instead of at its mouth. This curious phenomenon is described in the journal, *Science*, by Dr. C. N. Savage of Kent State University here.

The stream, known as Dead River, normally drains water from Androscoggin Lake into the Androscoggin River. Its course, mainly northwesterly, is six or seven miles long. It is very sluggish, since the usual difference in level between lake and river is only four or five feet.

However, during the time of spring freshets, the high-water level in the Androscoggin River becomes higher than the lake, and the current in the Dead River is reversed, so that it "flows backward" into the lake. At such times, the river water is heavy with rock silt, and this burden, dropped when the current of the Dead River enters the still water of the lake, is forming the delta.

The delta is now about one and one-half miles long and a quarter of a mile wide.

"DAWN REDWOOD" EXHIBIT IN CHICAGO NATURAL HISTORY MUSEUM

The "dawn redwood tree," a forerunner of the famous "big trees," sequoias, and giant redwoods of California and Oregon is found in China. The living American trees range in age form 1,200 to 2,000 years and are the oldest and most massive of all living things.

At the Chicago Natural History Museum the department of botany has just opened a special exhibit of the fossil members of the Chinese variety — Metasequoia. These are fifty-million-year-old relatives of our famous big trees. In addition to the fossils, the museum exhibit includes herbarium specimens and a wood sample of the only living member of Metasequoia recently discovered in remote parts of China — the nearly extinct dawn redwood whose vestigial surviving representatives make it what scientists call a "living fossil." The exhibit also includes pictures by Chinese botanists.

The Chinese species is smaller than those on our west coast, according to Dr. Theodor Just, chief curator of botany. Where the American trees attain heights up to 330 feet, and diameters from 12 to 17 feet, the largest living specimen known in China, which is also "the discovery tree," is 98 feet high and 68 inches in diameter. It stands by itself in the temple grounds at Mo-tao-chi, about 140 miles northwest of Chungking.

This Chinese conifer was unknown until as recently as 1945. Further exploration by botanists of the National Central University, Nanking, and the Fan Memorial Institute of Biology, Peiping, was made possible by American grants from the Arnold Arboretum in Jamaica Plain, Mass., and, as the result of this exploration, many seedlings are now growing in American botanical gardens. The Chinese species has been identified, says Dr. Just, with a fossil redwood described during World War II by a Japanese botanist, Shigeru Miki, from Pliocene clay deposits in Japan about seven or eight million years old.

WATER RESOURCES IN JULY

The drought in the Northeast continued unabated in July. Although stream flow was the lowest of record for July at many index gaging stations, daily discharges were well above the minimum flows of record. Ground-water levels are generally far below normal.

Runoff was excessive in the Southeastern and Gulf States. Major floods did not occur, but many small streams exceeded bankfull stages as a result of heavy local showers. In the West, the flow of the Colorado River continued to be excessive. In contrast, the Columbia River receded much more rapidly that usual following the spring rise.

— *Water Resources Review*

THE EARTH SCIENCE INSTITUTE
BULLETIN

Vol. I – No. 1 **August, 1949**

The Earth Science Institute Bulletin is published occasionally by the Earth Science Institute for its members. All communications should be addressed to Jerome M. Eisenberg, Executive Secretary, The Earth Science Institute, Revere, Mass.

The President's Column

The Earth Science Institute is a new, but still unproven, departure. Too long has geology been an unknown field to a large fraction of our population. Yet, there is no one single science which comes closer to the average citizen in economic, intellectual, and cultural significance. There are many avenues which may be followed in an endeavor "to disseminate accurate and widespread knowledge and appreciation of the earth sciences"; but for a time the Institute can only experiment until the best channels are discovered.

Certainly, one path lies in the direction of initiating geology classes at the high school level. Many students never continue their education beyond the high school; and for such students training in geology is probably far more advantageous than in chemistry or physics. It would seem that for non-college preparatory students, courses in geology and biology would be best suited in a broad scheme of education.

A further advantage arising from the offering of geology in high schools would be an increase in the number of students who would utimately register in college geology courses, for at the present time most students come to college without knowing of the existence of the field. More and better geology majors would undoubtedly result.

Still a further advantage would accrue to small school systems where the development and maintenance of chemistry or physics laboratories is too expensive to be adequately done. The geological laboratory in large part, is free; for the out-of-doors is completely available.

Into whatever channel the Earth Science Institute places its efforts much can be done, for an approximate vacuum now exists. I welcome all members of the Institute to our mutual endeavors for geology and to our mutual pleasure in the field.

C. W. WOLFE, *President*

Conference on the Teaching of Earth Sciences in the Secondary Schools

A Conference on the Teaching of the Earth Sciences in the Secondary Schools has been proposed by Dr. C. W. Wolfe. This meeting will be held in Boston sometime next spring, subject to the approval of the members. Invitations will be sent to science departments, school superintendents and science teachers in New England, and it will be publicized in national publications. It will be open to all those who are interested in this work. A program featuring noted geologists and educators will be planned. The date and tentative program will be announced later. All those interested in attending this meeting are requested to contact the Executive Secretary.

General Meeting to Be Held on September 30

The first general meeting of the Earth Science Institute will be held at Boston University, 725 Commonwealth Avenue, Boston, Mass., on Friday, September 30, 1949. Members will meet in the Geology Dept. (Room 4) at 8:00 P. M. Plans will be made for the Conference on the Teaching of the Earth Sciences in the Seconday Schools, the constitution will be discussed and ratified if approved, and future activities of the Institute will be formulated.

A Message from Dr. Raasch

As I have mentioned frequently, in the pages of the Earth Science Digest and elsewhere, popular interest in the cultural side of geology is increasing annually in a steeply rising curve. This pressure not only reaches me directly but also through the medium of the school and teachers who likewise feel this pressure from their students. Professional geologists on the other hand, abandoning the traditional "ivory-tower" attitude of the past generation, are to an increasing degree devoting time and thought to laison with the amateur and layman.

On the side of applied or economic geology, the industrialist and technician are annually becoming more aware of geological applications affecting their fields. As our industrial economy becomes more complex, moreover, the mineral requirements of industry become more exacting, more specific. Leaders within the profession are fully conscious of the fact that geology is not receiving its fair quota of new youth because the science receives so little attention in the primary and secondary school curricula.

The public, the professional geologist, the educator, now aware of the cultural and economic demands for geologists and geology, are trying to get together. But mere awareness and desire are not enough. Through the past half century, since the old days when the line between amateur and professional was largely an imaginary one, the profession has left the public far behind. Media for a common meeting ground — sound popular writings, personal contacts with amateurs, teachers, industrialists — are the bottle neck of the present period.

Such organizations as the Earth Science Institute are vitally needed to widen this bottle neck — to furnish a free channel for intercourse between these various groups that at long last have come to recognize their mutual needs and interests within the field of earth science.

GILBERT O. RAASCH,
1st *Vice-President*

EXCHANGES

Members desiring to exchange specimens, books, instruments, etc., may place exchange notices in the Bulletin. These must be limited to fifty words.

PHENACITE, gem quality, fine crystals, 50 oz. offered. Mineralight (Ultra-Violet Products, Inc.) type M-12 wanted. Godehard Lenzen, 14 Billwerder Strasse, (24a) Hamburg — Lohbruegge, Germany.

GARNETS; siderite, alone or with sphalerite, galena, pyrite; pyrite crystals on calcite; calcite crystals on limestone; talc; phlogopite; cleavelandite; dolomitic marble; hematite; limonite with fossils; torbernite; mountain leather; many others offered. Want the more uncommon minerals. Mrs. Irene U. Hartwell, Box 92, Roxbury, Conn.

WANTED: Books, pamphlets, magazines on the earth sciences, particularly early works (before 1870); isometric crystals. Offer minerals, books, back copies of The Earth Science Digest. Jerome M. Eisenberg, Box 28, Revere, Mass.

One of our members, Godehard Lenzen, has sent us the following list of German mineral collectors who would like to correspond and exchange specimens with American collectors:

Hans Engel, Nienhagen 14, Kreis Celle, Germany.

Georg Hauser, Franckestrasse 20, Kiel, Germany.

Dr. Max Heinisch, Karolinenstrasse 16, Hof, Bayern, Germany.

Fritz Kunstmann, Moosweg 20, Kressbronn a. B., Germany.

Hans Gruss, Moemlingen, Aschaffenburg, Germany.

Klaus H. Mueller, (24a) Hamburg — Blankenese, Falkenstein 46, Germany.

Walter Richt, Grafenberger Allee 81, Dusseldorf, Germany.

Charles F. Rieker, (24a) Hamburg 34, Blosweg 21, Germany.

Gunter Wirzing, Webern bei Klein-Bieherau, Darmstadt - 2 - Land, Germany.

THE INSTITUTE LIBRARY

The possibility of having a depository for printed matter and the need for a lending library was discussed at the organizing meeting. Contributions or books, magazines and other publications, for the Institute library will be gratefully acknowledged.

Books may be kept one month, and may be renewed once for the same period, except for reference books which are denoted by asterisks before the titles. A charge of 25¢ will be made for each volume to cover postage, packing, wear and tear, etc. Smaller publications (paper-bound booklets, magazines, etc.) will be sent out at the cost of postage (About 8¢ a pound). These charges do not include return postage. A fine of 2¢ a day will be charged on each book which is not returned according to the above rule. Each borrower is held responsible for all books drawn under his name.

The following books have been loaned to the Institute by the Executive Secretary. To these we hope to add standard reference books to be purchased by the Institute and contributions from the members.

Geology

Agassiz, L.—GEOLOGICAL SKETCHES (1866).

Avebury, L.—THE SCENERY OF ENGLAND AND THE CAUSES TO WHICH IT IS DUE (1902).

*Billings, M. P.—STRUCTURAL GEOLOGY (1942).

Blackwelder, E., and Barrows, H. H.—ELEMENTS OF GEOLOGY (1911).

Bretz, J. H.—EARTH SCIENCES (1940).

Brewster, E. T.—THIS PUZZLING PLANET (1942).

Brigham, A. P. — A TEXTBOOK OF GEOLOGY (1911).

Camp, C. L. S.P., and Green, M. — BIBLIOGRAPHY OF FOSSIL VERTEBRATES, 1939-1943 (1949).

*Cissarz, A., and Jones, W. R.—GERMAN-ENGLISH GEOLOGICAL TERMINOLOGY (1931).

*Cotton, C. A.—CLIMATIC ACCIDENTS IN LANDSCAPE MAKING (1948).

*——LANDSCAPE AS DEVELOPED BY THE PROCESSES OF NORMAL EROSION (2nd Ed., 1949).

Darwin, C.—CORAL REEFS (1896).

——GEOLOGICAL OBSERVATIONS (3rd Ed., 1897).

Dunbar, C. O.—HISTORICAL GEOLOGY (1949).

Emerson, F. V., and Smith J. E. — AGRICULTURAL GEOLOGY (2nd Ed., 1928).

*Flint, R. F.—GLACIAL GEOLOGY AND THE PLEISTOCENE EPOCH (1947).

Geikie, A. — OUTLINES OF FIELD-GEOLOGY (1879).

Geikie, J.—THE GREAT ICE AGE (1879).

*Glaessner, M. F. — PRINCIPLES OF MICROPALEONTOLOGY (1948).

Gosse, P. H.—OMPHALOS: AN ATTEMPT TO UNTIE THE GEOLOGICAL KNOT (1857).

Grew, E. S.—THE GROWTH OF A PLANET (1911).

Hobbs, W. H.—EARTH EVOLUTION AND ITS FACIAL EXPRESSION (1921).

Hutchinson, H. N.—EXTINCT MONSTERS (c. 1893) .

——THE STORY OF THE HILLS (1896).

Huxley, T. H. — PHYSIOGRAPHY: AN INTRODUCTION TO THE STUDY OF NATURE (1897).

Jenkins, O. P.—IRON RESOURCES OF CALIFORNIA (1948).

*Lalicker, C. G.—PRINCIPLES OF PETROLEUM GEOLOGY (1949).

Landes, K. K.—PHYSICAL GEOLOGY AND MAN (1948).

——and Hussey, R. C.—GEOLOGY ANI MAN (1948).

Le Conte, J.—A COMPEND OF GEOLOGY (1884).

——ELEMENTS OF GEOLOGY (5th Ed. 1905).

Lee W. T.—STORIES IN STONE (1927).

Longwell, C. R.—SEDIMENTARY FACIES IN GEOLOGIC HISTORY (1949).

——Knopf, A., and Flint, R. F.—OUTLINES OF PHYSICAL GEOLOGY (2nd Ed., 1941).

——Knopf, A., and Flint, R. F.—PHYSICAL GEOLOGY (3rd Ed., 1948).

Lubbock, J.—THE SCENERY OF SWITZERLAND AND THE CAUSES TO WHICH IT IS DUE (1897).

Lull, R. S., Barrell, J., Schuchert, C., Woodruff, L. T., and Huntington, E. —THE EVOLUTION OF THE EARTH AND ITS INHABITANTS (1918).

Lyell, C.—PRINCIPLES OF GEOLOGY (11th Ed., 1889), in 2 vols.

Mantell. G. A.—GEOLOGICAL EXCURSIONS ROUND THE ISLE OF WRIGHT (1854).

Miller, A. K. and Youngquist, W. — AMERICAN PERMIAN NAUTILOIDS (1949).

Miller, H.—EDINBURGH AND ITS NEIGHBORHOOD (4th Ed., 1870).

——FOOTPRINTS OF THE CREATOR (14th Ed., 1872; 1881).

——THE OLD RED SANDSTONE (4th Ed., 1851; 15th Ed., 1872).

——THE TESTIMONY OF THE ROCKS (1860).

Moore, R. C.—INTRODUCTION TO HISTORICAL GEOLOGY (1949).

*Nevin, C. M.—PRINCIPLES OF STRUCTURAL GEOLOGY (4th Ed., 1949).

Newell, N. D.—GEOLOGY OF THE LAKE TITICACA REGION, PERU AND BOLIVIA (1949).

Nicholson, H. A.—THE ANCIENT LIFE HISTORY OF THE EARTH (1897).

Norton, W. H.—THE ELEMENTS OF GEOLOGY (1905).

Ommanney, F. D.—THE OCEAN (1949).

Randall, S. S.—INCENTIVES TO THE CULTIVATION OF THE SCIENCE OF GEOLOGY (1846).

Read, H. H.—GEOLOGY, AN INTRODUCTION TO EARTH HISTORY (1949).

Reclus. E.—THE EARTH (1879).

Ries, H.—ECONOMIC GEOLOGY (4th Ed., 1916).

Roberts, R. D.—THE EARTH'S HISTORY (1893).

Russell, I. C.—GLACIERS OF NORTH AMERICA (1897).

Schuchert, C., and Dunbar, C. O.—OUTLINES OF HISTORICAL GEOLOGY (4th Ed., 1941).

Scott, W. B.—AN INTRODUCTION TO GEOLOGY (2nd Ed., 1912).

Seeley, H. G.—THE STORY OF THE EARTH IN PAST AGES (1902).

Shaler, N. S.—A FIRST BOOK IN GEOLOGY (1899).

Steele, J. D.—FOURTEEN WEEKS IN POPULAR GEOLOGY (1877).

Stumm, E. G.—REVISION OF THE FAMILIES AND GENERA OF THE DEVONIAN TETRACORALS (1949).

Taber, C. A. M.—THE CAUSE OF GEOLOGIC PERIODS (1907).

Tarr, R. S.—ELEMENTARY GEOLOGY (1897).

Teichert, C.—PERMIAN CRINOID CALCEOLISPONGIA (1949).

Tenney. S.—GEOLOGY (1st Ed., 1860; 2nd Ed., 1871).

Tyndall, J.—THE FORMS OF WATER IN CLOUDS AND RIVERS, ICE AND GLACIERS (1872-1898).

Winchell, A.—GEOLOGICAL EXCURSIONS (5th Ed., 1889).

——SPARKS FROM A GEOLOGIST'S HAMMER (1881).

——WALKS AND TALKS IN THE GEOLOGICAL FIELD (1886-1894).

Wright, G. F.—MAN AND THE GLACIAL PERIOD (2nd Ed., 1897).

Mineralogy, Petrology, Etc.

*Alling, H. L.—INTERPRETIVE PETROLOGY OF THE IGNEOUS ROCKS (1936).

Baxter, W. T. — JEWELRY, GEM CUTTING, AND METALCRAFT (2nd Ed., 1942).

Bayley, W. S. — ELEMENTARY CRYSTALLOGRAPHY (1910).

Brush, G. J., and Penfield, S. L. — MANUAL OF DETERMINATIVE MINERALOGY WITH AN INTRODUCTION ON BLOWPIPE ANALYSIS (15th Ed., 1899).

Cornwall, H. B.—MANUAL OF BLOWPIPE ANALYSIS AND DETERMINATIVE MINERALOGY (3rd Ed., 1891).

Crosby, W. O.—TABLES FOR THE DETERMINATION OF COMMON MINERALS (2nd Ed., 1891).

Dake, H. C., and Pearl, R. M.—THE ART OF GEM CUTTING (3rd Ed., 1945).

Dana, J. D.—MANUAL OF MINERALOGY AND PETROGRAPHY (6th Ed., 1888).

DeMent, J., and Dake, H. C.—HANDBOOK OF URANIUM MINERALS (2nd Ed.. 1948).

Endlich, F. M.—MANUAL OF QUALITATIVE BLOWPIPE ANALYSIS AND DETERMINATIVE MINERALOGY (1892).

English, G. L.—GETTING AQUAINTED WITH MINERALS (1934).

Erni, H.,—MINERALOGY SIMPLIFIED (1867).

Foote, W. M.—COMPLETE MINERAL CATALOG (12th Ed., 1909).

*Goldschmidt, V., and Gordon, S. G.—CRYSTALLOGRAPHIC TABLES FOR THE DETERMINATION OF MINERALS (1928).

*Grout, F. F.—PETROGRAPHY AND PETROLOGY (1932).

Hooker, W.—MINERALOGY AND GEOLOGY (1873).

Howard, J. H.—REVISED LAPIDARY HANDBOOK (1946).

Hunt, T. S.—CHEMICAL AND GEOLOGICAL ESSAYS (1875).

Hurlbut, C. S., Jr.—DANA'S MANUAL OF MINERALOGY (15th Ed., 1941).

——MINERALS AND HOW TO STUDY THEM (3rd Ed., 1949).

Murdoch, J., and Webb, R. W.—MINERALS OF CALIFORNIA (1948).

Nicol, J.—ELEMENTS OF MINERALOGY (2nd Ed., 1873).

Nininger, H. H.—OUR STONE-PELTED PLANET (1933).

Pearl, R. M.—MINERAL COLLECTORS HANDBOOK (1948).

——POPULAR GEMOLOGY (1948).
Pirsson, L. V., and Knopf, A.—ROCKS AND ROCK MINERALS (2nd Ed., 1926).
Rogers, A. F.—INTRODUCTION TO THE STUDY OF MINERALS AND ROCKS (2nd Ed.. 1921).
*——and Kerr, P. F.—OPTICAL MINERALOGY (2nd Ed., 1942).
Rogers, F., and Beard, A.—5000 YEARS OF GEMS AND JEWELRY (1947).
*Wahlstrom, E. E.—IGNEOUS MINERALS AND ROCKS (1947).
*——OPTICAL CRYSTALLOGRAPHY (1943).
Whitlock, H. P.—THE STORY OF THE MINERALS (1932).
Willems, J. D.—GEM CUTTING (1948).
Williams, G. H.—ELEMENTS OF CRYSTALLOGRAPHY (3rd Ed., 1892).

THE PROPOSED CONSTITUTION

The following is a rough draft of the proposed constitution, as formulated at the organizing meeting. Criticisms and suggestions will be welcomed. These will be incorporated into the proposed constitution if approved by those present at the general meeting of September 30, 1949, *and this final version will be voted upon and ratified by those present.*

Article I: NAME

Sec. 1: The name of this organization shall be: "The Earth Science Institute".

Article II: OBJECTS

Sec. 1: The Earth Science Institute is to be a non-profit organization created exclusively for education in and promotion of the earth sciences.

Sec. 2: The objects and purposes shall be: To disseminate accurate and widespread knowledge and appreciation of the earth sciences, especially in the United States.

Sec. 3: Toward this end the Institute specifically proposes to take steps to achieve the following:

A. The collection, preservation, publication, and exchange of findings and data;

B. The sponsorship of organizations, field work, and meetings;

C. The collection, identification, preservation, exhibition, and exchange of specimens;

D. Acquainting the public with the earth sciences.

E. The increase of educational opportunities in geology.

Article III: MEMBERSHIP

Sec. 1: Membership in this Institute shall be open to organizations and to individuals which/who shall indicate their interest in furthering the objects of the Institute and who shall comply with the requirements for membership.

Sec. 2: Any organization desiring admission to the Institute shall apply in writing to the Executive Secretary, giving its name, the name and address of its President and Secretary and number of members. Membership fees shall accompany the application.

Applications for individual membership, giving name and address shall likewise be submitted to the Executive Secretary.

Sec. 3: Any individual or organization wishing to withdraw from the Institute shall make such intention known in a written notice to the Executive Secretary. Acknowledgement of the receipt of such notice shall be sufficient to terminate the association. Members three months in arrears shall be automatically dropped.

Sec. 4: Should the attitude or conduct of any individual member or affiliated organization at any time be such as to be considered detrimental to the welfare of the Institute, such member may be expelled if the expulsion has been voted by a two-third's vote of the Executive Board.

Article IV: MEETINGS

Sec. 1: There shall be at least one meeting of this Institute annually, for the transaction of business and the election of officers. This meeting shall be held at a time and place to be designated by the Executive Board. Each individual member present shall have one vote. Each affiliated organization shall have one vote.

Article V: OFFICERS

Sec. 1: The officers of this Institute, who shall be elected for a period of one year, shall consist of: President, 1st Vice-President, 2nd Vice-President, Executive Secretary, Treasurer, and two Councilors. They shall take office at the adjournment of the annual meeting at which they are elected, and may not be elected for more than two consecutive terms, except that there shall be no time limit to the term of office of the Executive Secretary and Treasurer.

Sec. 2: The Nominating Committee shall be composed of at least three members appointed by the chair. It shall submit a list of candidates, to which list other nominations may be added. This slate shall be considered by the Executive Board and if the candidates are approved, placed in nomination. This slate shall be voted on at the annual meeting, as provided above. Voting may be by mailed ballot or by ballot of the annual meeting.

Article VI: THE EXECUTIVE BOARD

Sec. 1: The officers of this Institute and two members elected at large at the annual meeting by a majority vote shall constitute the Executive Board which shall transact such business as shall be deemed necessary. The Executive Board shall establish its own by-laws to govern its procedure.

Article VII: STAFF

Sec. 1: The Executive Board shall appoint a Staff at the annual meeting to conduct the business and editorial matters of the Institute.

Sec. 2: The Staff shall consist of a Director and such assistants as shall be deemed necessary by the Executive Board. The compensation of the Staff, if any, shall be fixed by the Executive Board.

Article VIII: COMMITTEES

Sec. 1: The Executive Board may appoint the following standing committees: a Committee on Publications; a Committee on Projects; a Committee on Finance; a Committee on Geologic Education; a Committee on Membership. The Nominating Committee shall be appointed by the Chair.

Article IX: DUES AND FEES

Sec. 1: Annual dues shall be as follows: Regular membership, $5; Associate membership (non-voting), $3; Supporting membership, $10; Sustaining membership, $25; Organizational membership, $10. Life membership shall be $100; Patron membership shall be $500. No further dues shall be required for Life and Patron memberships.

Article X: PROCEDURE

Sec. 1: Robert's **Rules of Order** shall govern the procedure in all general meetings except as specifically provided for above.

Article XI: RATIFICATION AND AMENDMENT

Sec. 1: This Constitution shall be considered to be in effect when it has been approved by the organizing committee and shall be considered ratified when so voted by a majority at the first general meeting.

Sec. 2: Amendments to this Constitution shall be considered adopted when they have been passed by a two-thirds vote of the Executive Board and approved by a majority vote in an annual meeting.

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